

Application No. 10/664,659
Response to Office Action

Customer No. 01933

Listing of Claims:

1. (Currently Amended) A semiconductor light emitting device comprising:

(i) a support substrate made of a first semiconductor material;

(ii) a light emitting lamination structure disposed on the support substrate, the light emitting lamination structure comprising:

a quantum well layer made of a second semiconductor material,

a pair of carrier confinement layers made of a third semiconductor material having a band gap wider than a band gap of the second semiconductor material, and said pair of carrier confinement layers sandwiching the quantum well layer, and

a pair of clad layers made of a fourth semiconductor material having a band gap wider than the band gap of the third semiconductor material, and said pair of clad layers sandwiching ~~layers comprising the quantum well layer and the pair of carrier confinement layers,~~

wherein a composition of the second and semiconductor material, a composition of the third semiconductor materials material and a thickness of the quantum well layer ~~satisfy a condition~~ are set such that a difference of at least 100 meV ~~or~~

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~~larger~~ exists between an energy level of the carrier confinement layers at a conduction band lower end and a ground level of an electron in the quantum well layer; and

(iii) electrodes for injecting carriers into the light emitting lamination structure.

2. (Currently Amended) A The semiconductor light emitting device according to claim 1, wherein a band gap of the first semiconductor material is wider than an energy level corresponding to a wavelength at ~~which~~ a peak of a light emission spectrum of the quantum well layer ~~appears~~.

Claim 3 (Canceled).

4. (Currently Amended) A The semiconductor light emitting device according to claim 1, wherein the first, third and fourth semiconductor materials are one of GaAs ~~or~~ and AlGaAs, and the second semiconductor material is InGaAs.

5. (Currently Amended) A The semiconductor light emitting device according to claim 4, wherein an In composition ratio of the second semiconductor material is not less than 0.05 ~~to~~ and not more than 0.25, and a ~~relation~~ relationship between a
5 thickness of the quantum well layer and the In composition ratio

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of the second semiconductor material ~~satisfies a condition~~ is set
such that an emission light wavelength is 800 to 920 nm.

6. (Currently Amended) ~~A~~ The semiconductor light emitting device according to claim 4, wherein an Al composition ratio of the third semiconductor material is not more than 0.4 ~~or smaller~~.

7. (Currently Amended) ~~A~~ The semiconductor light emitting device according to claim 1, wherein a thickness of each of the carrier confinement ~~layer~~ layers is thinner less than 120 nm.

8. (Withdrawn - Currently Amended) ~~A~~ The semiconductor light emitting device ~~comprising~~ according to claim 1, wherein:
~~a support substrate made of the first semiconductor material~~
is a group III-V compound semiconductor material, and ~~having the~~
support substrate has a principal surface that is one of a (100) plane ~~or and~~ a crystalline plane having an inclination angle of not more than 2° ~~or smaller~~ from the (100) plane; and

~~a~~ the light emitting lamination structure is disposed on the principal surface of the support substrate, and the light emitting ~~lamination structure comprising a quantum well layer~~
~~made of~~ second semiconductor material is a group III-V mixed crystal semiconductor material containing In, ~~a pair of carrier~~
~~confinement layers made of semiconductor material having a band~~

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~~gap wider than the quantum well layer and sandwiching the quantum well layer, and a pair of clad layers made of semiconductor material having a band gap wider than the carrier confinement layers and sandwiching layers comprising the quantum well layer and the pair of carrier confinement layers, wherein materials of the quantum well layer and the carrier confinement layers and a thickness of the quantum well layer satisfy a condition that a difference of 100 meV or larger exists between an energy level of the carrier confinement layers at a conduction band lower end and a ground level of an electron in the quantum well layer; and electrodes for injecting carriers into the light emitting lamination structure.~~

9. (Withdrawn - Currently Amended) ~~A~~ The semiconductor light emitting device according to claim 8, wherein the support ~~substrate~~ first semiconductor material is made of GaAs and the quantum well layer second semiconductor material is made of InGaAs.

10. (Withdrawn - Currently Amended) ~~A~~ The semiconductor light emitting device according to claim 8, wherein an In composition ratio of the quantum well layer is not more than 0.12 or smaller.

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11. (Withdrawn - Currently Amended) A The semiconductor light emitting device ~~comprising according to claim 1, wherein:~~
~~a support substrate made of the first semiconductor material~~
~~is a group III-V compound semiconductor material, and having the~~
~~support substrate has a principal surface that is one of a (100)~~
~~plane or and a crystalline plane having an inclination angle of~~
~~not more than 0.2° or smaller from the (100) plane; and~~
~~a the light emitting lamination structure is disposed on the~~
~~principal surface of the support substrate, and the light~~
~~emitting lamination structure comprising a quantum well layer~~
~~made of second semiconductor material is a group III-V mixed~~
~~crystal semiconductor material containing In, a pair of carrier~~
~~confinement layers made of semiconductor material having a band~~
~~gap wider than the quantum well layer and sandwiching the quantum~~
~~well layer, and a pair of clad layers made of semiconductor~~
~~material having a band gap wider than the carrier confinement~~
~~layers and sandwiching layers comprising the quantum well layer~~
~~and the pair of carrier confinement layers, wherein materials of~~
~~the quantum well layer and the carrier confinement layers and a~~
~~thickness of the quantum well layer satisfy a condition that a~~
~~difference of 100 meV or larger exists between an energy level of~~
~~the carrier confinement layers at a conduction band lower end and~~
~~a ground level of an electron in the quantum well layer; and~~

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~~electrodes for injecting carriers into the light emitting lamination structure.~~

12. (Withdrawn - Currently Amended) A semiconductor light emitting device according to claim 11, wherein the ~~support substrate~~ first semiconductor material is made of GaAs, the ~~quantum well layer~~ second semiconductor material is made of InGaAs, and an In composition of the quantum well layer is not more than 0.25 or smaller.

Claims 13-17 (Canceled).

18. (Withdrawn - Currently Amended) A The semiconductor light emitting device ~~comprising according to claim 1, wherein:~~
~~a support substrate made of the first semiconductor material~~
is a group III-V compound semiconductor material, and having the support substrate has a principal surface that is one of a (100) plane or and a crystalline plane having an inclination angle of not more than 5° or smaller from the (100) plane; and

a the light emitting lamination structure is disposed on the principal surface of the support substrate, and the light emitting lamination structure comprising a quantum well layer made of second semiconductor material is a group III-V mixed crystal semiconductor material containing In and having an In

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~~composition ratio of not more than 0.12. or smaller, a pair of carrier confinement layers made of semiconductor material having a band gap wider than the quantum well layer and sandwiching the quantum well layer, and a pair of clad layers made of semiconductor material having a band gap wider than the carrier confinement layers and sandwiching layers comprising the quantum well layer and the pair of carrier confinement layers, wherein materials of the quantum well layer and the carrier confinement layers and a thickness of the quantum well layer satisfy a condition that a difference of 100 meV or larger exists between an energy level of the carrier confinement layers at a conduction band lower end and a ground level of an electron in the quantum well layer; and~~

~~electrodes for injecting carriers into the light emitting lamination structure.~~

Claim 19 (Canceled).